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High School Students' Mathematical Communication Skills Through Ethnomatematics-Based Realistic Mathematics Learning Approaches in Geometry Transformation Materials

Kusnul Hotimah [1*], Isnawati Lujeng Lestari [2]
[12]Institut Teknologi dan Sains Nadhlatul Ulama Pasuruan
[1]khusulhotimah063@gmail.com, [2]isnawati@itsnupasuruan.ac.id
*Correspondence

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Abstract

Mathematical communication ability is the ability of students to use mathematics as a form of communication (the language of mathematics) and student's ability to convey the mathematics they learn as the content of the message to be conveyed. This study aims to describe the Mathematical Communication Skills of High School Students Through an Ethnomatematics-Based Realistic Mathematics Learning Approach on Geometry Transformation Materials. This research is a type of descriptive research with a qualitative approach. The selection of subjects used in this study used an interpersonal intelligence questionnaire, which involved all students of class XI IIS 3 State Islamic High School 1 Pasuruan. Based on the interpersonal intelligence questionnaire scores, three subjects were selected with high, medium, and low levels of interpersonal intelligence. Then, these three subjects will examine the student's ability to draw the correct solution, explain the answer systematically, and construct a problem into a mathematical model. The results of this study indicate that the mathematical communication skills of students with high, medium, and low levels of interpersonal intelligence have many differences in problem-solving on the questions given.

INTRODUCTION

In the National Education Curriculum, mathematics is taught at every level of education and class much more often than other subjects. This indirectly shows that mathematics is expected to develop students' abilities and potential. The mathematical skills expected to be achieved by students from elementary to secondary levels are aligned with process standards.

Mathematical communication ability is the ability of students to use mathematics as a means of communication (the language of mathematics) and to convey the mathematics they learn as the content of the message to be given. Mathematical communication skills can also be translated as students' ability to communicate something they know through dialog events or reciprocal relationships in their environment, where messages are transferred between students (Ahmad, 2018). Prayitno et al. (2013) revealed that mathematical communication is how students convey and explain mathematical ideas orally or in writing, whether in pictures, tables, diagrams, formulas, or demonstrations.

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On the other hand, Hodiyanto (2017) says that mathematical communication skills are students' ability to Convey mathematical ideas orally and in writing. Based on the opinions of several experts previously stated, the researcher concluded that mathematical communication ability is the ability of students to (1) draw the correct solution, (2) explain the solution systematically, and (3) construct a problem into a mathematical model convey ideas and construct a problem into a mathematical model in the form of pictures, tables, diagrams, and formulas both orally and in writing.

To attract and increase students' motivation to participate in learning and improve their communication skills to solve problems in the learning process, it is necessary to develop fun strategies and ways of learning that are fun for students (Afriansyah, 2016). One strategy that can be used is to apply the suitable learning model in the ongoing learning process. With the help of appropriate learning models, students can improve their mathematical communication skills. According to Bray & Tangney (2016), the Realistic Mathematics Learning Approach is an approach to learning mathematics that involves students developing their' understanding by involving problems set in a context that involves students' interests, with the teacher rearranging the students' mathematical findings that are confronted. Through this active student involvement, students are expected to be able to practice good mathematical communication skills. This type of learning approach is used because, in general, students do not have the opportunity to communicate to ask and answer questions from other students and the teacher.

According to Rachmawati (2015), Ethnomatematics is mathematics practiced by cultural groups, such as rural and urban communities, labor groups, children of specific age groups, indigenous peoples, and others. Ethnomathematics are the unique ways specific communities or cultural groups carry out mathematical activities. Mathematical activities are activities carried out where there is a process of abstracting from actual experiences in everyday life into mathematics or vice versa, including activities of grouping, calculating, measuring, designing buildings or tools, making patterns, calculating, determining locations, playing, defining, and so on (Rakhmawati, 2016). Ethnomatematics can be an alternative method teachers use to make it easier for students to understand geometric transformation math material. Ethnomatematics is expected to improve students' mathematical communication skills.

In improving student communication, realistic mathematics learning based on ethnomathematics is used. Realistic mathematics learning based on ethnomathematics is an approach to learning mathematics that does not have to be a problem in the real world (real world problems) and usually occurs in students' daily lives caused or based on culture and grows and develops in society and accordance with culture. as a basis for building concepts so that they are believed to be able to solve the problems they face. The problems faced by students, in general, are commonly faced with solving the problems faced by students using several ways, namely by using an Ethnomatematics-Based Realistic Mathematics Learning Approach.

Geometry Transform Materials are mathematical operations that describe the geometry of an object to change its position, orientation, or size. Geometry

Transformation material is a low-ability formal mathematics material taught in schools. This is because students abstractly view geometric transformation material. Therefore, teacher learning skills are needed to encourage students to develop mathematical communication skills and improve students' thinking, creative, critical, and conceptual abilities.

METHOD

The research used in this study is a qualitative approach. Moleong (2014) defines qualitative research as a procedure that produces descriptive data in the form of written words from the observable behavior of people. Researchers used quantitative and qualitative data to obtain the required data in this study. Quantitative data in this study were in the form of written and oral mathematical communication ability test data. The qualitative data, namely the description of high school students' mathematical communication abilities on geometric transformation material through an ethnomathematics-based realistic mathematics learning approach.

They determined the subject in this study using an interpersonal intelligence questionnaire and consideration of the mathematics teacher. The considerations in determining the subject of this study were based on the teacher's considerations in the mathematics studies field and the score of the interpersonal intelligence questionnaire based on the level of students' interpersonal intelligence. The subjects in this study were students of class XI IIS 3 State Islamic High School 1 Pasuruan for the 2022/2023 academic year. At the same time, the number of subjects taken based on the student's interpersonal intelligence questionnaire score was 3. The subjects selected were one student with a high level of interpersonal intelligence, one with a moderate level of interpersonal intelligence, and one with low interpersonal intelligence. The choice of 1 subject in each category aims to allow researchers to examine their mathematical communication abilities in more depth.

RESULTS

Based on the interpersonal intelligence questionnaire results, six students were found in the high interpersonal intelligence category, 16 were in the moderate interpersonal intelligence category, and five were in the low interpersonal intelligence category. To determine the research subjects in the high interpersonal intelligence category, the researcher chose SRH as a research subject because it has the highest questionnaire score and is a student who is active in learning mathematics. Whereas for subjects with moderate interpersonal intelligence, the researcher chose NRM because the scores obtained had a more excellent range of values than SMF and were students I enjoyed participating in learning mathematics. Then, for research subjects in the category of low interpersonal intelligence, the researcher chose SMF as the research subject because it had the lowest questionnaire score and was a passive student participating in mathematics learning. The following are selected research subjects.

Table 1 Research Subjects

No.	Initial Name	Code	Score	Interpersonal Intelligence Category
1.	SRH	ST	178	High
2.	NRM	SS	156	Medium
3.	SMF	SR	135	Low

Information:

ST: Subject with a high level of interpersonal intelligence
SS: Subject with a moderate level of interpersonal intelligence
SR: Subjects with a low level of interpersonal intelligence

After determining the research subject, apply an Ethnomatematics-Based Realistic Mathematics Learning Approach. Furthermore, the research subjects were given verbal and written tests of mathematical communication skills. I was checking the validity of the data using data triangulation and method triangulation. Data analysis used Miles and Huberman's stages: data reduction, presentation, and conclusion.

Table 2 Equalities and Differences in Mathematical Communication Ability

To Indicator	Equality	Difference
1	ST, SS, and SR can correctly draw the mirror axis and center of rotation and explain how to position the mirroraxis correctly and the center of rotation correctly	
2	ST and SS can accurately describe the center of rotation, explaining how to determine the exact rotation result	ST can determine the exact results of the rotation.
		SS can draw how to put the position of the mirror axis, but it is not quite right in explaining how to draw the reflection results, but it is not quite right
		SS draws the result of the bounce, but it is incorrect and does not determine the result of the round. It explains how to draw the result of the bounce, but it is not correct and does not determine the result of the round
3		ST can use mathematical notation or symbols to solve problems in determining coordinates and determining

Based on the explanation above, it is known that there are many differences between subjects with mathematical communication skills with high, medium, and low

levels of interpersonal intelligence. This is in line with the concept of Positive Intrapersonal and Intrapersonal by Barber (2005), which shows that the level of intelligence is one of the variables that can cause differences in research results. Syafaati's research (2018) shows something similar to strengthen the results of this study related to mathematical communication skills with interpersonal intelligence levels. Based on this research, there are similarities with the results of this study, namely, subjects with high levels of interpersonal intelligence can already obtain data information that can help students.

DISCUSSION

Discussion of research results based on results related to mathematical communication skills in an ethnomathematics-based realistic mathematics learning approach. Similarities and differences in the mathematical communication abilities of students who have high interpersonal intelligence, moderate interpersonal intelligence, and low interpersonal intelligence categories

1. Students' Mathematical Communication Skills in Ethnomatematics-Based Realistic Mathematics Learning with High Interpersonal Intelligence (ST) Category

On the indicators of expressing mathematical ideas by speaking, writing, demonstrating, and describing them visually, ST can state and write down information that is known and asked in questions correctly, and nothing is missed. To determine the known information from a question, ST pays attention to the order of the questions first. Then, ST will look for parts of the data suitable for making tables or diagrams. ST only needs to read the whole question once and then repeat it. Again, please write it down on the answer sheet provided. ST is also very relaxed and confident in stating the information contained in the problem.

ST can precisely make representations in tabular form in indicators representing thoughts and ideas through diagrams, graphs, or tabular form. Even though the table is not neat, it can describe the data information in the problem. To provide information on the column, ST pays attention to the words that appear frequently in the questions.

2. Mathematical Communication Skills of Students in Ethnomatematics-Based Realistic Mathematics Learning with Moderate Interpersonal Intelligence (SS) Category

The indicators express mathematical ideas by speaking, writing, demonstrating, and describing them visually. SS subjects can state and write down the information contained in the questions in the form of things that are known and asked correctly. However, the subject still looked hesitant when stating the information. In order to get known information, SS had to read the problem repeatedly while paying attention to the numbers. SS subjects can make representations according to the questions in the indicators representing thoughts and ideas through diagrams, graphs, or tabular form. However, providing information on the table still needs to be emphasized again so that the table created can describe the data provided. The subject revealed that he was challenged to make words.

3. Students' Mathematical Communication Skills in Ethnomatematics-Based Realistic Mathematics Learning with Low Interpersonal Intelligence (SR) Category.

On the indicators of expressing mathematical ideas by speaking, writing, demonstrating, and visually describing them, SR subjects can mention and write down known information and ask neatly and in the order of the problem. However, the subject is still halting and seems to think long in conveying information. To determine the known information in the problem, the subject must first be asked to read and seen by the researcher when working on the problem because if not seen, the SR subject will just be silent and daydreaming. Furthermore, the subject will read the problem by first paying attention to the questions.

In the indicators representing thoughts and ideas through diagrams, graphs, or tabular form, SR subjects can make representations in tabular form neatly and precisely. The subject can also make a statement according to the problem given. As with the previous indicators, to solve the questions given by the SR subject, they must be asked first and seen by the researcher when working on the problem.

CONCLUSION

Based on the results of the research and discussion, the researcher concluded that the results of the Written Mathematical Communication Skills Test of students with high interpersonal intelligence were able to draw the mirror axis, center of rotation, and reflection results correctly and use mathematical notation or symbols to determine the image coordinates and determine the rotation angle entirely and correctly. Then, the results of the Oral Mathematical Communication Ability Test showed that the student was able to explain how to position the mirror axis and center of rotation, how to draw reflection results and determine rotation results correctly, and how to use mathematical notation or symbols to determine image coordinates and determine rotation angles. Completely and correctly.

Meanwhile, the mathematical communication skills of students with medium interpersonal intelligence have resulted in the Written Mathematical Communication Ability Test being able to use mathematical notation or symbols to determine complete image coordinates but still get wrong results and determine incomplete rotation angles. Then, the results of the Oral Mathematical Communication Ability Test were that students were still not precise in explaining how to draw reflections and used mathematical notation or symbols to determine the image, so they got the wrong coordinates.

The last one concerns students' mathematical communication skills with low interpersonal intelligence. The results of the Written Mathematical Communication Ability Test are that students are not very precise in drawing reflection results, cannot determine the results of rotation, and do not use mathematical notation or symbols to determine image coordinates and rotation angles. Meanwhile, the Oral Mathematical Communication Ability Test results were inaccurate in explaining how to draw

reflections and determine rotation results. They did not mention mathematical notation or symbols to solve the problem of determining image coordinates and rotation angles.

Based on the results of the research that has been done, the researchers put forward the following suggestions: a) Students who have a low level of interpersonal intelligence have difficulty expressing information in solving problems, so special treatment is needed from the teacher in order to increase the level of interpersonal intelligence and students can also understand the material by Good. b) The Ethnomatematics-Based Realistic Mathematics Learning Approach can be an alternative for teachers in developing students' mathematical communication skills. c) For further research, switching to various other intelligences is better so that the results obtained vary. This research only examines students' mathematical communication abilities from one of the multiple intelligences, namely interpersonal intelligence.

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